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— AS TO A —  
MODIFIED TECHNIQUE.  
BY  
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## AN EXPERIMENTAL STUDY OF INTESTINAL ANASTOMOSIS—WITH SOME PRACTICAL SUGGESTIONS AS TO A MODIFIED TECHNIQUE.

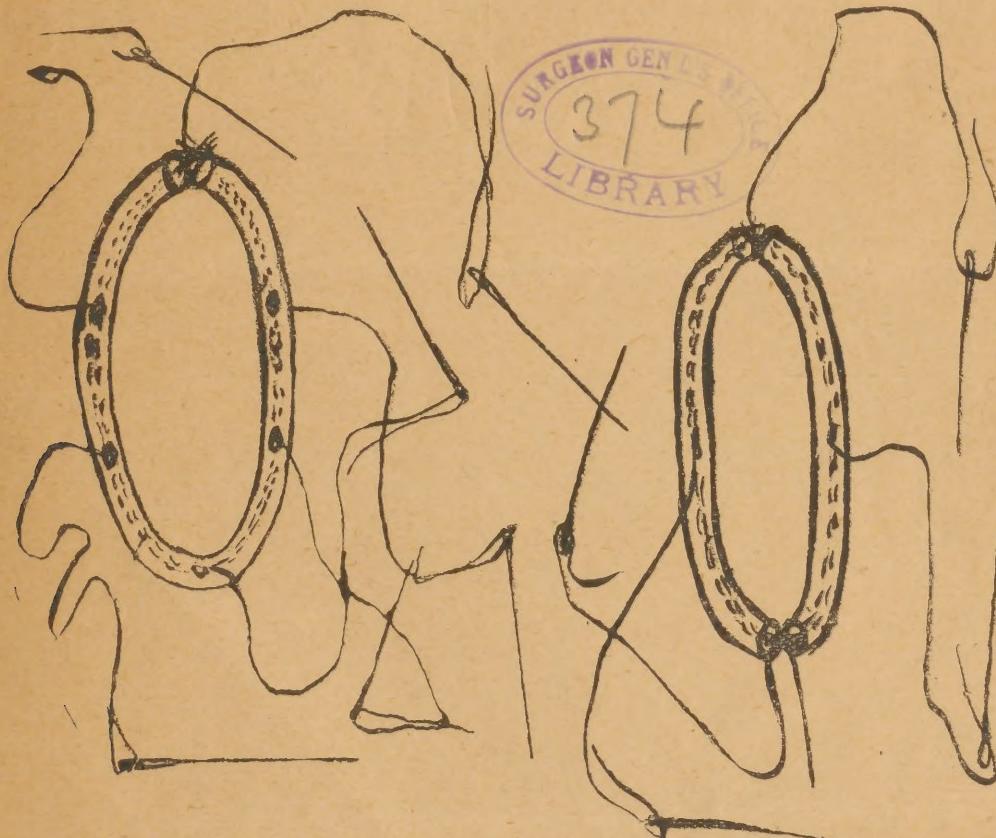
BY A. V. L. BROKAW, M.D.,

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Until Nicholas Senn gave us the results of his labors in the field of intestinal surgery, the prospect for great success in such operations was rather unpromising; but all agree now, I think, that he has reduced some of the most difficult problems in intestinal work to a basis of absolute simplicity. Operations which heretofore consumed one, two or more hours, even in the hands of surgeons noted for their rapidity and skill, can now, by a knowledge of the technique of Senn, or the more recent modification suggested by Abbe of New York, be completed in a very few minutes.

The intestinal anastomoses formed by the use of decalcified bone-plates as used by Senn, and the catgut rings of Robt. Abbe are both very excellent methods. After experimenting with the methods mentioned, I believe I have devised a far more simple technique, and offer as a substitute, rings of unperforated rubber tubing, which, if prepared in the following manner, will greatly simplify the process of forming intestinal anastomosis:

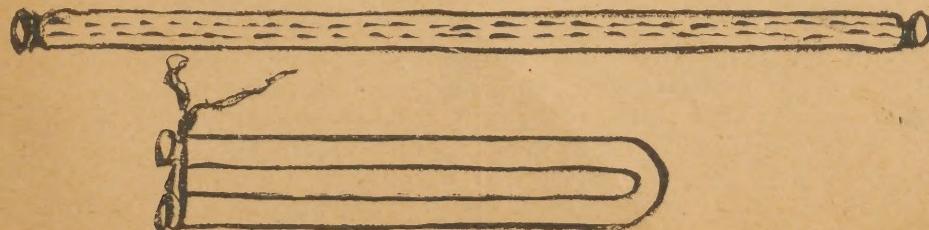
Unperforated drainage tubing of a diameter less than one-fourth inch is selected. For most work the white-ribbed tubing of one-seventh or one-fifth inch in diameter is preferable. Of this a section is taken some three inches long, or even longer, according to the size of the opening desired. Through the lumen of this section of tubing are passed several strands of dried juniper catgut; these strands are left to protrude for some distance from the extremities of the tubing to facilitate the process of tying. We now have an elastic ring which is oval and maintains its shape until the catgut



Intestinal ring made of a piece of rubber tubing.

Strands of catgut (.....) within the Tube to which tie the approximation thread. (—)

Intestinal rubber ring made of two pieces of tubing.



Clamps of No. 12 copper wire covered with rubber tubing.

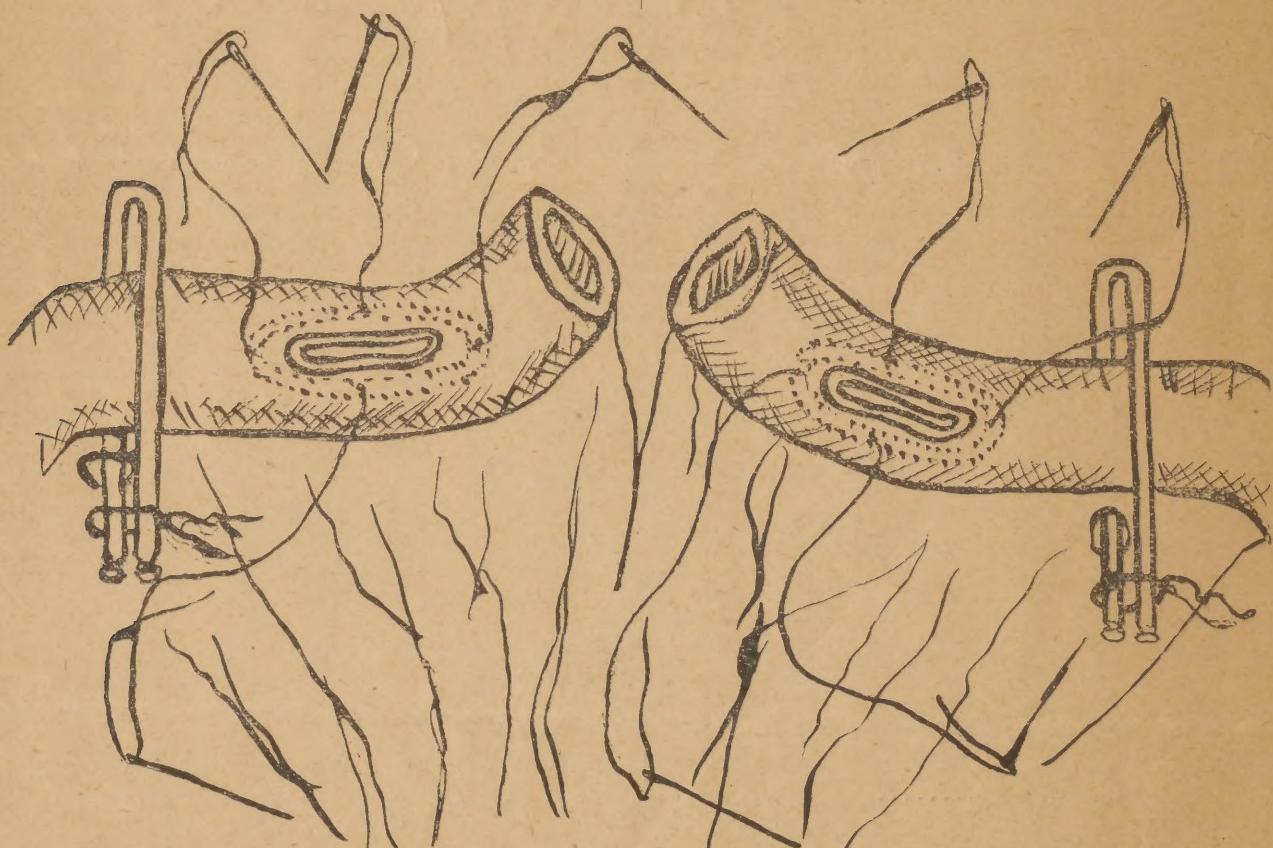
strands within the tubing give way. It then straightens out and passes from the bowel. Four to six small slits or openings are made equidistant in the sides of the ring and through these are passed fine silk; these ligatures are then caught and fastened to the strands of catgut within the ring, as described above. This avoids the formation of knots and irregularities and aids the ready throwing off of the rings when the catgut is absorbed. It now only remains necessary to thread the needles. If catgut apposition-threads are used—and I find that with these, the ring comes away some days earlier than when silk threads are used—it is only necessary to attach the apposition strands direct to the rubber tubing, thus avoiding the trouble of attaching the threads, if silk be used, to the gut-strands within the ring. To avoid tangling of the threads and unnecessary waste of time, I have found it convenient to place the ring thus finished upon an antiseptic towel or flat sponge, keeping the needles apart.

With two such rings I find the operation of intestinal anastomosis extremely easy. The advantages claimed for rings so prepared are, that on compressing laterally the ring, its introduction through the intestinal opening, even though the latter be quite small, is very easy, and the ring

sorbed by the action of the intestinal fluids upon them.

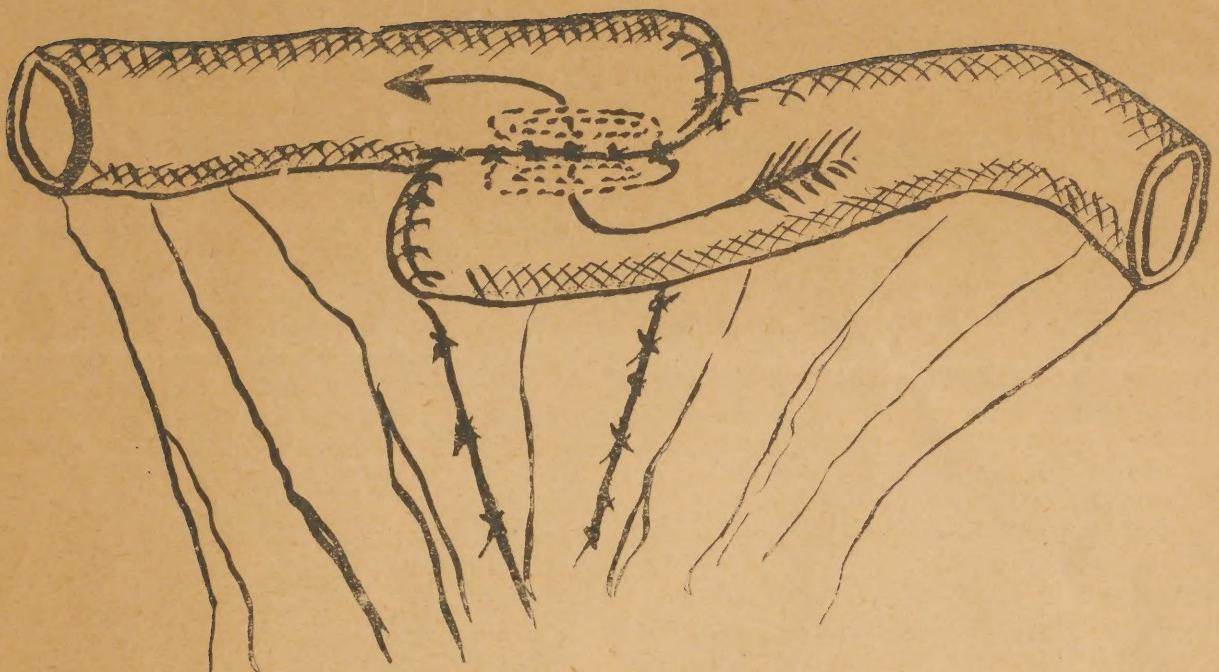
The simplicity in the preparation of these rings is a strong plea in their favor, for, in case of emergency, they can be made in a few moments during the operation. Senn's plates are difficult to prepare and the opening is sometimes rather small. The catgut rings of Abbe are most excellent, but I find that to give them a fair preparation requires too much trouble and time. The rubber rings cannot kink or curl up, but on absorption of the catgut strands within the rings, they become straight and offer no obstruction in their passage. Bone-plates, when not soon absorbed, may block up the intestinal opening by becoming impacted, and an unequal absorption of catgut rings might form an obstructive meshwork at the point of anastomosis.

Before opening the gut, it is necessary in most all cases to apply clamps, or a temporary elastic ligature distally and proximally to prevent fecal extravasation. Very small drainage tubing, one-eighth or one-fourth inch in diameter, is frequently used for the purpose by passing it through the mesentery and tying it around the intestine. This answers very well, but an inexpensive clamp, which may be used with advantage, may be prepared in this manner: Six or seven inches of No.



immediately resumes its oval shape within the intestine. There is no tendency to a lateral falling together of the wound-margins or lessening of the aperture, which might occur by the softening of catgut rings. From numerous experiments on dogs, I find that the resulting aperture is all that could be desired. The rubber ring is thrown off *per viam naturalem* as soon as the catgut strands within the tube are softened and ab-

12 copper wire are covered with unperforated rubber drainage tubing of small size. The extremities of tubing over lapping the ends of the wire are ligated and the rubber-covered wire is bent upon itself. The clamp is applied by slipping it over the free margin of the intestine, at the same time pushing the lower blade through the mesentery, fairly close to its junction with the intestine. The blades are made perfectly parallel and an



Illustrating an anastomosis after enterectomy.

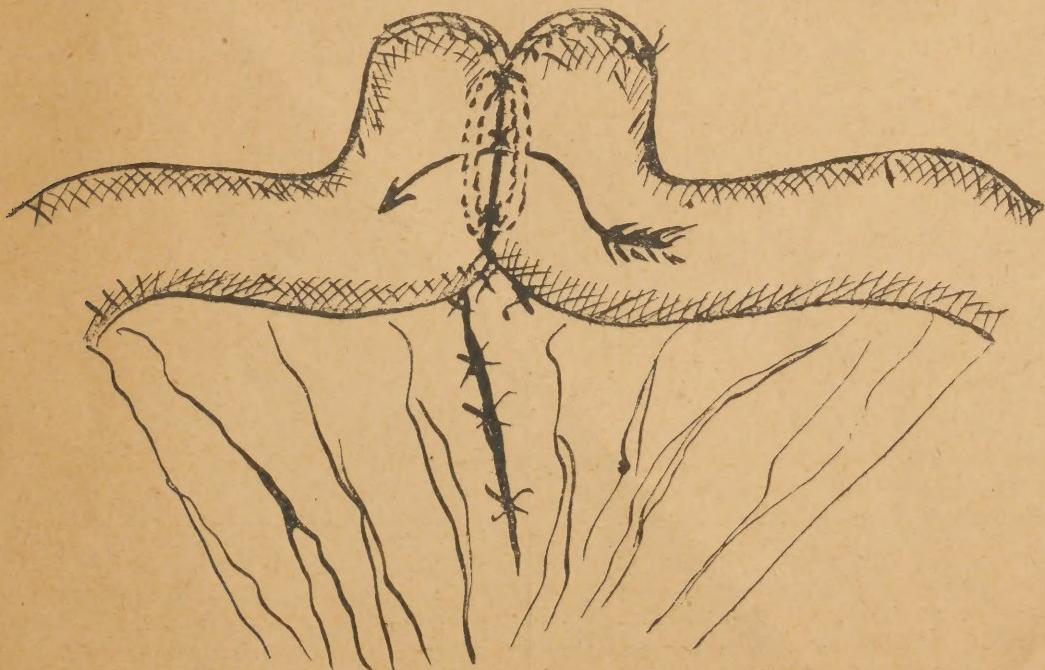
elastic band or ligature is thrown around the ends. This little appliance is very simple and has several advantages; it holds the intestinal walls evenly together, aiding the assistant in holding securely the intestines while the rubber rings are being introduced and tied in position.

The manner of applying the rings in forming an intestinal anastomosis is exceedingly simple. Compress the ring, pass it into the lumen of the bowel or stomach, as the case may be, pass the threads at the end of the oval first and then the lateral threads. Now make slight traction to ascertain whether the ring rests well in place; pass the second ring in the same manner, appose and tie.

Scarification of the marginal serous surface as suggested by Senn is of undoubted value, since it increases plastic exudation and creates greater promise of union.

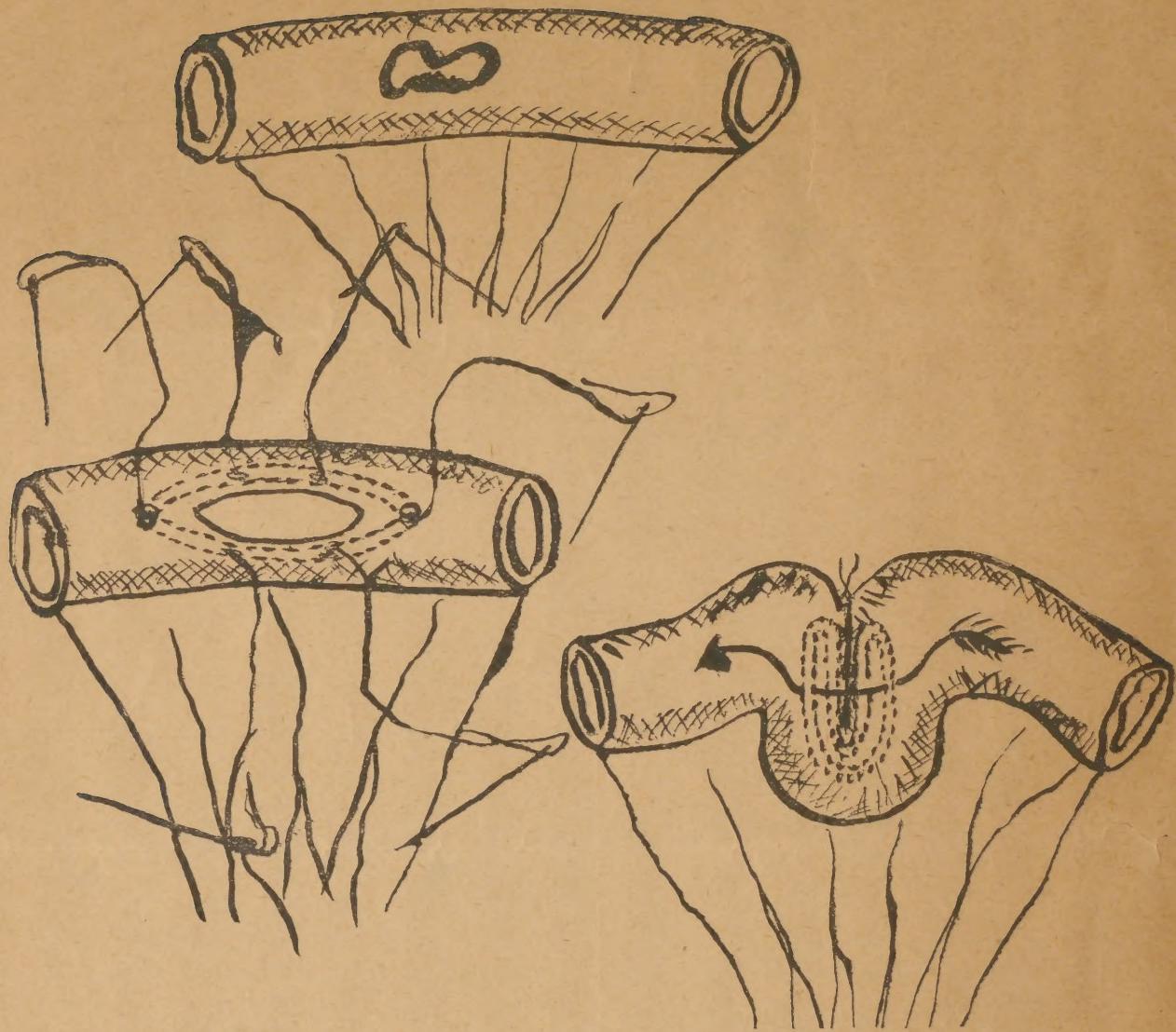
A few Lambert sutures at several points add to the safety; this can be done after tying the apposition threads.

After many experiments, I think I have devised a method of treatment, which may in some cases of gunshot injury of the intestines be of value. If the wounds be not too close together, especially where a stenosis might follow suturing, the method to be explained seems to answer the purpose admirably, as proven by experimental studies. If the wounds are wide apart each one should be dealt with separately. The margins of the wound should first be carefully trimmed with scissors; the oval ring, selected for the purpose, should be of good length, the aperture about two and one-half inches. Six threads of apposition should be used with this ring, so arranged that when tied they will hold the oval ring bent evenly on itself. One thread at each end of the ring and two on each side are desir-



Illustrating an anastomosis after an enterectomy.

Gunshot wound.



Ring in the intestine before tying.

Ring bent double and sutured in position.

able. The ring is now introduced into the bowel and doubled upon itself, then the threads are tied, beginning with the end strings and afterwards with the lateral. The addition of a few Lembert sutures adds to the security.

The apparent flexion of gut thus produced will be found to have as great, if not greater, lumen at the point of flexure than the neighboring parts of the intestine. Other isolated wounds may be treated in the same manner. If two wounds are in the same loop of intestine, I would suggest the use of two ordinary sized rings, the trimming of the wound edges and the formation of anastomosis. When more than two wounds are found close together, an anastomosis by lateral apposition, after excising the damaged portion of the bowel, would be far better than attempting the classical circular enterorrhaphy.

These principles of operative procedure may be applied to a great number of similar cases, e. g., to perforated typhoid ulcerations of the bowels, etc.

To sum up the whole, the substitute offered seems to be in every respect an improvement. The great trinity of attributes in surgery—especially abdominal surgery—is simplicity, safety, rapidity, and the technique proposed in this paper, I believe, embraces them all.

**NOTE I.**—Rings made from two equal sections of tubing pass from four to six days earlier than those made of a single section; *vide* illustrations of rings.

**NOTE II.**—In my experimental operations on 12 dogs,

but one dog died, and this death was not the direct result of the operation, for the dog did well until the 6th day, when he tore out the abdominal sutures; as a result, the intestines were extruded and became covered with dirt. This was not noticed for probably several hours; when it was discovered, I replaced the viscera into the abdominal cavity after washing them thoroughly; the dog died four hours later of peritonitis and shock.

**NOTE III.**—In the operation described above for treatment of gunshot wounds with a single ring, there may be some tendency to eversion of the margin of the bowel at the point of flexure; to prevent this I find that a single cat-gut suture passed through the margins of the wound at the point of flexion is all that is necessary. The suture need not be drawn tight enough to bring the wound-margins together; I usually leave them about a quarter of an inch apart. This step should always follow the introduction of the ring.

**NOTE IV.**—In my third series of experiments upon seven dogs, the rings used were made of from four to six equal sections of tubing in the manner described. This modification of the original ring, made of single or double sections of tubing, is probably of decided value, as the small segments come away earlier. In a gastroenterostomy made Aug. 3, some of the segments of the rings used were found on the ninth of August. The closure of a large opening in the free surface of the bowel (size of a half-dollar) may be made in five minutes, and with practice in less time.



